

VII. *Illustrations of the 6th ♂ ventral segment in 17 Osmia-species of the adunca-Group, with a Note on the synonymy of four species, and descriptions of four which seem new.* By the Rev. FRANCIS DAVID MORICE, M.A., F.E.S.

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PLATES VII AND VIII.

HAVING dissected numerous ♂♂ of *Osmia*, Pz., representing among them, I believe, 17 palæarctic species of the *adunca*-Group, I find that in all of them the hidden 6th ventral segment of the abdomen has a very elaborate and singular structure (reminding me a good deal of the 7th ventral in *Colletes*)—evidently highly specialised for some important (probably sexual?) function.

In each, the segment in question emits from its apex a distinct and conspicuous membranous appendage of some paradoxical form, which form differs so much in the various species that many can be distinguished by it at a glance.

How far this structure is peculiar to or universal in the *adunca*-Group, I cannot yet say. But so far I have only found it there, and in one little "maniple" of species (one of which may be *crenulata*, Mor., and the others undescribed) which, according to present ideas, would be grouped, but as I suspect not rightly, with *papaveris*. Neither *papaveris* itself nor its allies, *cristata*, *saundersi*, *bisulca*, etc., have any such appendage to the 6th ventral, and the character seems to me fully as important as the form of the 7th dorsal, on which the groups of *papaveris* and *adunca* are at present separated.

Unfortunately the segment cannot be viewed, without dissection of the specimen. But when extracted, its beautiful forms and most interesting structure amply repay the trouble of bringing it to light; and the characters presented by it in the various species are so clear and constant, that I think they well deserve an attention which has not yet been paid to them by the framers of specific diagnoses. In no Group of the Genus, perhaps, have describers been less successful in so characterizing their

species as not to mislead later students. Hence the synonymy of the Group has long been in great confusion, and in several cases that confusion seems to me to be rather increasing than diminishing, in spite of all attempts (even the most recent) to clear it up.

As to the definition of the *adunca*-Group, the following diagnosis, founded mainly on the works of Schmiedeknecht and Ducke, represents, I believe pretty completely, the views on this subject now generally received, as far as ♂ characters are concerned.

♂. Corpus nigrum haud metallicum, fulvo vel pallido mediocriter pilosum. Abdominis segmenta dorsalia anteriora apicibus plus minusve pallido fimbriatis; sextum lateribus dentatis sinuatisque; septimum subquadrate productum, apice nec dilatato, nec spinoso, nec profunde emarginato. Segmenta ventralia quinque semper apparent, marginibus omnium fere simplicibus (nunquam profunde excisis nec acute productis), omnia mutica (tuberculis, etc. nullis) saepius tamen ante apicem transverse subcallosa.

Clypeus productus marginē apicali crenulato. Antennae nonnullis saltem articulis plerumque aliquo modo deformatis, vix unquam simpliciter cylindricis.

To these characters—among which those of the ventral segments are perhaps the most important—I would propose, on the strength of my recent investigation, to add the following—

♂. Segmentum ventrale sextum quinto obtectum, magna parte et praesertim appendice conspicua apicali membranaceum; septimum propter emarginaturam apicalem magnam bilobatum; octavum parte apicali lata, emarginaturam septimi fere totam implente, lateribus parallelis, apice et in medio plerumque membranacea. Genitalia sagittis latissimis, subfalcates; stipitum parte apicali tenuissime elongata, subcylindrica—apicibus ipsis plerumque evidentiter inflexis.

For the 7th and 8th ventral segments, see Fig. 20; for the genitalia, Fig. 21.

I believe that some of these latter characters should have at least as much weight as those given above in determining the true limits of the Group, if, as seems likely, it be a "good" one.

It does not fall within the scope of this paper to deal with ♀ characters, but the universally pale *scopa* (white or grey) may be mentioned as among the most obvious.

Before discussing the separate species, it may be worth while to describe in some detail the general structure of the 6th ventral segment in the *adunca*-Group and the general nature of the specific characters which occur in it. To draw it undamaged from its retirement under the 5th ventral is not always easy. My own method is, after relaxing a specimen, to force apart with a dissecting-needle the 5th and 6th dorsal segments. Being rather firmly attached to the base of the latter, the 6th ventral generally comes out with it. It is then seen to be formed of several distinct layers superposed one upon another, some quite thin and hyaline, others more substantial and darker. Most of these at least do not extend to the base and apex of the segment, but occupy a part only of its full length. The actual base is pretty solid. It is deeply excised, accordingly *bidentate*—the two teeth are attached externally to the 6th dorsal by a membrane, which must be cut through carefully, if the segment is to be extracted entire. Beyond the basal excision begins the thickest and most substantial part of the segment. We see here, first, but (owing to their transparency) only in certain lights, two adjacent flakes of thin white membrane, attached only at their bases (the rounded apices being quite free) to the underlying layers of substance. Below these flakes, and partly at least projecting beyond them apically, is a much more solid transverse layer (or conglomerate of layers) divided longitudinally into two well-marked *lobes*—dark, punctured, and more or less pilose, especially towards their apices laterally. These I shall call in the following descriptions the “main lobes” of the segment. From between these lobes, at a rather lower level, originates the apical membranous appendage which I shall call the “process.” It, also, usually assumes a somewhat bilobed form; but in two species it is, instead, terminated by a single central (spine-like) prolongation. The base of the “process” rarely occupies the whole space between the converging margins of the “main lobes.” More usually it has a constricted petiole-like base, from which the lobes of the bifid apex branch out more or less in the lateral direction, making the process as a whole roughly Y-shaped in some cases, T-shaped in others. The petiole of a Y-shaped process is mostly long and narrow, that of a T-shaped much more transverse (compare Fig. 7 with Fig. 11). Round these two types, the Y-shaped (*cæmentaria*), and the

T-shaped (*morawitzi*), most of the "processes" I have figured seem to group themselves. And it will be found that with each type of process a corresponding type of main lobes is associated—the apical margins of the latter running somewhat parallel to the lobes of the process, so that with a "Y-shaped process" they converge very obliquely or *diagonally*, embracing a great triangular gap in which lies the process; while with a "T-shaped process" they run nearly or quite transversely, there is no deep triangular gap, but the process stands out clearly and boldly beyond the lobes. Also in the latter case the lobes have sharp lateral corners, generally armed with an actual spine or tooth, though occasionally this is too much deflexed to be conspicuous in the ventral view of the segment. In segments of the *cæmentaria* type, on the contrary, the lobes are untoothed, their apices are rounded or subtruncate. (In such a case as Fig. 15 the process is no doubt somewhat Y-shaped, but I should class the segment as a whole under the other type, that of *morawitzi*, because the petiole of the process is wider than it ever is in the *cæmentaria* type, the lobes of the process are, after all, more transversely divergent, the apical margins also of the main lobes running on the whole rather transversely than diagonally, and terminating in an acute angle armed with a distinct though deflexed tooth.)

In the longitudinal *sulcus*, or narrow slit which separates the two main lobes, another tooth-like object usually shows itself, which, however, seems to be really only a pencil of excessively stout and spine-like hairs. This, in segments of the *cæmentaria* type, seems to be generally ill-developed or even absent.

The pilosity of the main lobes may differ greatly even in closely related species (cf. Figs. 11 and 13). As to the process, its apical lobes are generally densely clothed externally with excessively fine hairs, varying in length and direction according to the species. Seldom (Figs. 2, 3, 4) the process is practically naked. In one case (Fig. 1) it is naked as a whole, but armed with two strong bristly pencils before the apex, quite unlike anything to be seen in any of the other species.

A comparison of the characters presented by this segment in different species of the Group seems to me to furnish rather important evidence as to the precise degree of affinity in which certain of these probably stand to

others. Still I do not mean that I would propose to classify the Group according to these characters *only*.

We may now proceed to consider my Figures of this segment in the several species examined by me. In each case, after describing the segment, I shall say what I consider the species possessing it to be, and where necessary, shall give reasons for my belief, and mention other specific characters of the insects under consideration.

I shall then add a separate note on the synonymy of four especially puzzling species, and lastly give Diagnoses of four other species of which I have been unable to find descriptions, so that I am obliged to treat them as "new."

Fig. 1. The main lobes are rather angular laterally at the apex, but unspined; their apical margins run only a little obliquely: the tooth-like hair pencil in the groove which separates them is conspicuous.

The basal part of the process is not petiole-like, but very wide and almost rectangular. Before its apex are a pair (near together) of conspicuous tubercles each emitting a strong pencil of erect long hairs. The apex itself runs out suddenly into a sort of long narrow spine, which laterally (Fig. 1a) is seen to be much deflexed.

This species is, I believe, universally accepted as the true *adunca*, Latr.

It is characterized by its black calcaria, shining somewhat naked dorsal segments, the form of its antennæ, etc., and also in the ♀ (a character as yet, I believe, unnoticed), by the production of the last ventral segment at its apex into a triangular, somewhat reflexed, spine.

I have examined specimens from all parts between Algeria and the Sea of Marmora, which completely agree in the characters given above, and with the descriptions of all authors consulted by me.

Fig. 2. The main lobes have rounded apices and their margins run diagonally. Central hair pencil hardly developed, and pilosity altogether short and thin.

The process is nearly triangular, with no tubercles or pencils as in *adunca*. Its apex is drawn out gradually into a spine; first deflexed, then again reflexed and a little dilated (Fig. 2a).

The specimens before me are some of those I took in Syria and Asia Minor in the spring of 1889, which have been described by Friese (Entom. Nachricht.) under the name *lysholmi*.

Fig. 22 shows its moniliform and almost clavate antenna, which would alone distinguish it from any other species of the group.

Fig. 3. The apices of the main lobes are rather narrowly but not angularly truncated, their apical (rather straight) margins run more obliquely than in *adunca*. Central hair pencil distinct.

The arcuate apical margin of the process is incised in the centre (therefore bilobed). Between the lobes (before this incision) rises a strong double longitudinal carina, which laterally (Fig. 3a) shows as a procumbent compressed tooth. The base of the process is quite unstricted, filling the whole space between the main lobes.

This is a very fine large insect, like a colossal *adunca* (length fully 16 mm.). I took one specimen in Algeria, and Mr. Saunders has another, probably from the Ionian islands, taken long ago by Sir S. S. Saunders. It seems to be undescribed, and I propose to call it *manicata*.

The antennæ are formed much as in *adunca*, but it has pale hind calcaria, the base of the median "area cordiformis" with long clear striæ, and the front tarsi very densely fimbriated with long white hairs (*manicata*).

The metapleuræ are more shining and less closely punctured than in *adunca*. The apex of the 6th dorsal segment is very strongly crenate (even *crossed*) with a large central emargination. The 5th ventral is more shining, with a larger puncturation (sparser on the disk), its apical margin widely though gently sinuated inwards.

Of the flagellum, joints 3—5 are evidently wider than long, 6—8 quadrate, 9—11 longer than wide; 3—7 gibbose behind, 11—12 concave behind, convex in front (cf. Figs. 23, 23a).

The pilosity of the face, breast, and legs is whitish, the rest bright fulvous, as are also the apical fasciæ of the abdominal dorsal segments.

Fig. 4. The main lobes have rounded apices, their margins subarcuate and diagonally converging. The central hair-pencil conspicuous.

The process is usually simple in form; it is nearly hairless, its base unstricted, its apical margin arcuate and hardly emarginate in the centre (scarcely bilobate). There is no definite tooth-like carina as in Fig. 3a, but a slight wide central (longitudinal) elevation before the apex.

Perez has described this species as *morawitzi*, Gerst., and

his description is quoted in full by Schmiedeknecht. But it can hardly be the *morawitzii* of Ducke; and I have reason to think that the true *morawitzii*, Gerst. (= *loti* Moraw.) is yet another species.

See on these points the note appended at the end of this paper, and my figures of the antennæ (♂) in the species there discussed. The latter I have drawn each in several points of view (1) from in front—the *widest* aspect; (2) from above—the *narrowest*; (3) from behind—to display as fully as possible the convexities of the separate joints. The present species is represented in Figs. 24, etc.*

This insect—*morawitzii*, Perez, as I shall call it for the present—I have taken freely in Algeria and occasionally in South France (never further east!). It frequents *Echium*, which *loti* (*teste*, Morawitz) does not.

To the characters given by Perez the following may be added.

Intermediate and hind femora in both sexes acutely spined at their apices (Fig. 19). The character is unusual, and striking (when not concealed by the tibia). ♂ Hind metatarsus unusually elongate, measuring quite $\frac{4}{5}$ of the tibia (in *adunca* less than $\frac{3}{5}$). ♀ Last ventral segment produced at the apex as in *adunca*, but into a *narrower* spine, rather linear than triangular, and not (as in *adunca*) red but black. (I must own that I cannot follow Perez in his description of the last dorsal segment which seems to me *less* and not *more* impressed transversely than that of *adunca*.)

The calcaria vary strangely in colour. They may be quite pale or almost as black as in *adunca*!

Fig. 5. Apices of the main lobes sharply angular, but a little deflexed which gives them a truncate look, their slightly convex margins run rather obliquely.

The process has a distinctly constricted petiole-like base; at the apex it is divided by a triangular incision into two slightly pilose reniform lobes which widen gradually from apex to base.

This is one of the "types" of Friese's *pici* taken by me in Syria, and described by him in Ent. Nachricht. As

* Although I have taken extreme care in placing the antennæ as horizontally as possible, some joints are inevitably foreshortened differently in different aspects. So their comparative lengths cannot be reckoned with precision from these figures.

he has fully described its external characters, I will only add a figure of the antenna (Fig. 25) to show its curious dilatations and hook-like apex.

Fig. 6. Main lobes rounded with rather widely truncated apices, and densely hairy (yet with hardly any definite central pencil). Their margins, as also those of the two next species, run very diagonally, embracing an almost equilaterally triangular space in which lies the basal portion of the process, nearly filling it.

The process has a distinct narrow petiole, from which proceed two gradually widening pilose plume-like lobes, their outer margins running parallel to the sides of the triangular gap above mentioned, and almost touching them; their inner margins are separated by a long narrow and linear gap till near the apex, where the lobes are rounded off and the gap between them widens. The greatest width of the lobes (a little before their apices) measures about $\frac{2}{3}$ of their greatest length.

The species is common in the Mediterranean regions: I have taken it in France, Italy, Switzerland, Austria and Algeria. Ducke calls it *spinolæ*, Schenk.; but as he does not consider it to be the *spinolæ* of Lepelletier, and as it is generally admitted to be the *cæmentaria* of Gerstæcker, under which name it has frequently been referred to by well-known writers, I prefer to follow Schmiedeknecht and call it *cæmentaria*, Gerst. The insect being well known, I will here only mention that in the ♀ the apical ventral segment is not, as in *adunca* and *morawitzi*, Perez, produced spinosely at the apex.

Fig. 7. The main lobes differ from those of *cæmentaria* in being hardly truncate but almost angled (roundly however) at their apices.

The process is very like that of *cæmentaria*, but does not so nearly fill the triangular gap containing it. The lobes are much narrower (quite three times as long as broad), they spring from a longer petiole (which removes their inferior margins from the main lobes, while in *cæmentaria* these almost touch each other), they widen comparatively little towards their apices, so that the division between them is wider and more triangular, giving them the appearance of being more divergent.

This species I take to be *Lepelletieri*, Perez. It completely suits his description (5th ventral segment "trisinué," comparatively simple antennæ, etc.). I have taken it

myself only in the Alps. It seems to be a decidedly near relation of *cæmentaria*, though easily distinguishable from it. (It also has ♀ ventral apex, not spinose!)

Fig. 8. Differs from Fig. 6 (*cæmentaria*) chiefly in the outline of the main lobes, which are more completely oval, their inner margins much more convex, which diminishes the triangular gap between them, and seems to thrust the process further out towards the apex of the segment.

The process (except in its situation, as just stated) is almost identical with that of *cæmentaria*.

I have only one specimen of this insect (from Rome) and am rather unwilling to make a new species of it, since I can only find one substantial external character to distinguish it from *cæmentaria*. That however is a very strong one, unless indeed it be an individual malformation, viz. the last joint of the antennæ is strongly excavated, making its tip into a bent narrow spine or hook—much as in *pici*, only the joint is shorter and the hook more abrupt. The other joints are simple, and resemble those of *cæmentaria* (see Fig. 26).

Supposing it to be not a monstrosity, but a species of which other examples may occur, I propose for it the name *romana*.

Fig. 9. The apices of the main lobes are acute, and show underneath the transparent upper layer of their thickened part, distinct sharp lateral teeth or spines (though the actual margin, formed by the layer mentioned above, is not spinose but only angulated). The margins run a little obliquely, hardly diagonally, less as in the species lately described than as in those which are to follow.

The process also is more of the type which will hereafter present itself. It has a wide transverse petiole, more solid and somewhat clouded down the middle, from which are thrown off, not in an apical or diagonal direction but *transversely* (horizontally in the figure) two shortly pilose lobes with a very shallow incision or emargination between their apices. The lobes in this case are almost round, as wide as long, not elongated as in most of the species.

My specimens ♂♂ and ♀♀ are all from Palestine or Syria. I can find no description of the species, which from the rounded fan-like lobes attached to the 6th segment (as above stated) I propose to call *flabellifera*.

It has a good deal the aspect of *lepelletieri*, to which however it cannot, I think, be really a very near relation.

Perhaps its most striking ♂ character is in the last dorsal segment. This is very broad and somewhat bilobate (see Fig. 31), quite unlike any other in this group, to which however I am satisfied that it belongs. (For other characters see the Diagnoses which follow.)

Fig. 10. Not unlike the last, but the main lobes with more transversely running margins, evidently spinose at the apices, only the teeth are deflexed, so that the segment must be viewed from in front to see them satisfactorily.

The process more transverse, its lobes being rather narrower and longer, their direction completely transverse.

This, I believe, is *jheringi*, Ducke. Herr Alfken gave me a pair from Triest, and I have specimens which seem identical, which I took in Egypt. It is described in Ducke's recently published supplement to *Apidæ Europææ* (Genus *Osmia*).

Fig. 11. Apices of the main lobes very sharp and evidently spinose, their sides before these teeth show a very long and conspicuous pilosity (unlike anything yet encountered, but usual in the species which are to follow).

The process with a wide petiole; the lobes long, narrow and pointed, their apical margins gently sinuated, and clothed (as are the lobes throughout) with fine, rather long, incurved hairs.

This, I believe, is the true *loti* ♂ Moraw. (= *morawitzi*, Gerst.). See the Note following this paper, where I discuss its characters.

I have only taken two specimens (Petit Salève near Geneva), see Figs. 20, 21, 27.

Fig. 12. Differs from the last chiefly in the shape of the process, whose transverse lobes are more widely separated at their bases; they are broader in proportion to their length, and their superior or apical margins are much more abruptly and deeply sinuated near the apices, the corresponding curve in *morawitzi* being so gentle and gradual as to be hardly noticeable.

The spinose angles, lateral pilosity (a little shorter, however,) direction of margin, etc., of the main lobes almost exactly as in *morawitzi*.

This is *difformis*, Perez; but not Ducke's *difformis*, who describes the present species I believe under the name *morawitzi*, Gerst. (See the Note above mentioned for discussion of this question.) For the antennæ see Figs. 28, 28a, 28b.

Fig. 13. The main lobes shaped like the last, but their apical margins, if possible, even straighter, and the lateral spinosity still more marked. Their pilosity however is very different, being quite short and scanty at the sides.

The process is most conspicuously "T-shaped," its apical margin running quite transversely with almost no sinuation. It is clothed with intensely fine and regular hairs; and the inferior margins of the lobes and the longitudinal interval between their bases is marked by a distinct and well-defined brown stain on the otherwise vitreous substance, which gives the segment a peculiar and seemingly constant appearance in all my specimens.

This is certainly *pallicornis*, Friese (= *difformis*, Ducke nec Perez. See Note at the end of this paper).

I figure its very curious ♂ flagellum in Figs. 29, 29a, 29b.

My specimens are from Asia Minor and Syria, Mr. Saunders has others from the Ionian Islands.

Fig. 14. Exceeding like Fig. 11, but the main lobes have more convex apical margins, and their lateral teeth are even stronger than in *difformis*. Lateral pilosity (as in Fig. 11) well developed. The lobes of the process are more widely separated at their bases, and the apical margin is decidedly trisinate (the central sinuation most marked).

This is a "typical" specimen from Majorca of *insularis*, Schmiedeknecht, given to me by Herr Friese. It is evidently a near relation of *loti* and *difformis*.

Fig. 15. Main lobes sharply angled, with deflexed lateral teeth (only conspicuous when the segment is viewed from its apex). Their apical margins unusually concave, running almost in a single continuous curve.

Process peculiar, the lobes being very parallel-sided (almost oblong); set very obliquely—so as to embrace with their apical margins a large triangular gap (the triangle, however, rather right-angled than, as in Figs. 7, etc., acute-angled); and clothed, especially at their apices with long incurving hairs.

My specimens are from Algeria mostly, but a few (quite like the rest) from Jaffa. I believe that they may safely be referred to *fertoni*, Perez, to whose description they completely answer. They have not the punctuation of his *albi-spina* which I have seen. The species nests in snail-shells.

Fig. 16. Main lobes with angles spined as in *fertoni*, but the apical margins more convex.

Lobes of process much shorter, and widened from base to apex, so that they are nearly adjacent throughout, and the gap between them is inconspicuous—much deeper than wide. The pilosity is also shorter.

I take this species to be *vaulogeri*, Perez, judging however only from the description of that species. It is a good deal like *jheringi* (Fig. 10), but the process is certainly not identical. (Its hairs are quite otherwise directed.) I have examined two specimens from Algiers.

Fig. 17. The main lobes differ from any yet examined, in that their apices lie in the centre of the segment, the margins descending thence (instead of rising or running transversely) towards the spined lateral angles. Consequently they (*i. e.* the apices) form a pair of acute adjacent angles overlapping the base of the process—an easily recognizable character!

The process is hardly to be distinguished from that of *morawitzi*, but its lobes are a little wider in proportion to their length. And, owing to the descending outline of the main lobes, it stands out more boldly at the sides.

I think this species must be undescribed. I took it (♂♂ and ♀♀) at Brumana near Beirut (Syria) in 1899, and propose to call it *libanensis*. For its external characters, see the Diagnosis given below. (For its ♂ antenna, Fig. 30.)

The fifth ♂ ventral segment is decidedly peculiar, but whether its singularity has anything to do with that of the 6th I cannot venture to say, though I suspect so.

Below its actual, (centrally incised but otherwise simple,) somewhat transparent margin, may be seen a sort of secondary inner margin, formed by a thicker darker and more solid layer of substance. This "ante-margin," if we may so call it, is incised (like the true margin) in the centre, and at the corners it is evidently and sharply spinose—like the 6th segment. Also, laterally (near the base) it emits two oblique pencils of thin long hairs, which can be seen projecting on each side, even when the abdomen is viewed from above. I have not noticed a similar character in any other species.

Besides the above 17 species, I took near Jerusalem in 1899 what is evidently yet another (probably undescribed) species of the same group, with a curiously triangular (almost acuminate) 7th dorsal segment, and a 6th ventral

somewhat like that of *cæmentaria*. But I do not describe it, as it is a single specimen, and in poor condition.

Note on the synonymy of four species.

It seems to me quite impossible that the *difformis* of Duce (= *pallicornis*, Friese) should be identical with Perez's *difformis*.

In the former, according to Duce's and Friese's figures and also my own specimens (Figs. 29, 29a, and 29b), the basal joints of the flagellum are excessively broad as seen in front, and the inferior margins of the basal joints form a series of sharp serrations, while those of the following joints are at least gibbosely dilated. Duce and Friese also describe the apical joint as acute ("zugespitzt"), and it is so in several specimens belonging to Mr. Saunders, though hardly so (except when showed laterally) in that which I have figured (Asia Minor), (Fig. 29).

Now of his *difformis* Perez describes the antenna most minutely, and the following tabulation will show how absolutely it differs from that of Duce's species—

Difformis Perez (sec. ipsum).

Second joint of flagellum "à peu près aussi large au bout que long."

Last joint "once and a half as long as wide, en ovale irrégulier."

Upper and lower margins of flagellum straight "non arrondis comme chez L'O. *Morawitzi*."

Posterior "saillies" of flagellum most marked on joints 2-4, hardly indicated on 5-6, redeveloped on joints following.

Joints 5-6 narrower than those adjoining.

Flagellum evidently twice bent "en arrière puis en avant," the first bend occurring "au niveau de" joints 5-6.

(For a flagellum really answering to this description see my Fig. 28a.)

Difformis Perez (sec. Duce).

Second joint at least once and a half as wide as long.

Last joint quite three times as long as wide, narrowly conical, tuberculate near base below. (See Duce's Fig.)

Lower margin with all the apical joints "arrondis" and all the basal sharply serrate.

"Saillie" on joint 2 not more marked than those on 5-6, which are acute and prominent, more so than on any of the joints following.

Joints 5-6 as wide or rather wider than those adjoining.

Flagellum almost imperceptibly bent between joints 6, 7 and again between joints 8, 9. (See Duce's Fig. b.)

In every one of these items except the last the two sides of the table contradict each other absolutely, and even in that their agreement is imperfect.

Furthermore, Duce says in a footnote that an "angeblich typisches" pair of *difformis* sent by Perez to Friese were not *difformis* and must have been sent as such by mistake. He adds that Perez's *description* (though not

these "types") "passt genau auf *pallicornis*, Friese": a statement, which considering the characters cited above, I am quite unable to understand.

If then Perez's *difformis* is, as maintained above, not identical with *pallicornis*, what is it?

I believe it to be a species not uncommon on the Alps, whose antennæ (Figs. 28, etc.) correspond in every respect to those of *difformis* as the author describes them, while in other characters also it corresponds and especially in the somewhat dull and closely punctured fifth ventral segment—that of *pallicornis* being punctured much more sparsely and very shining.

Now this species, I feel certain, is Dücke's *morawitzii*. Perez's *morawitzi* it cannot possibly be, if only on account of the 5th ventral segment (*morawitzi* "brillant, ponctuation espacée!") But Dücke's *morawitzii* I believe it is! The antenna he figures under that name resembles those of my Swiss specimens, and fits much better with Perez's description of *difformis* than with that by the same author of *morawitzi*. Also in the footnote above cited Dücke says that the *difformis*-types sent to Friese by Perez "sich als *morawitzii* erwiesen." If *difformis*, Perez = *morawitzii*, Dücke nec Perez, that is natural! And surely it is far more likely that Perez and Dücke should differ in their idea of *morawitzi*, than that the former author should have mistaken for his own species (*difformis*) another (*morawitzi* sec. Perez) which he has so carefully distinguished from it in his well-known papers on the subject.

I had not only written thus far, but (as I supposed) had completed this paper, when a kind communication from Professor Perez entirely confirmed the views above stated. He has sent specimens both of *difformis* and of *morawitzi* as described by himself. *Difformis* is not *pallicornis*, but is the species of my Figs. 12, 28, etc. and also (I believe) the *morawitzii* of Dücke. *Morawitzi* is a species to which none of Dücke's descriptions correspond, which I have taken freely in South France and Algeria, and to which belong my Figs. 4, 24, etc.

This latter species (*morawitzi*, Perez nec Dücke) we have now to consider. Is it, or is it not, the *morawitzi* of Gerstæcker = *loti* ♂ Morawitz (nec ♀?)?

Gerstæcker not having described but only renamed the insect, we are thrown back upon Morawitz's description of his *loti* in Horæ Rossic. V, p. 68, in which the ♂ flagellum is

said to be "in der Gegend des siebenten gliedes deutlich gebogen" and "die vordere Fläche ist abgeplattet, die hintere aber tritt stark hervor." These, as Perez points out, are characters of the present species (*morawitzi* sec. Perez). It has a flagellum bent once (not twice as *difformis*) about the 7th joint, and the joints up to the 10th have evident posterior dilatations or "saillies" creating "une serie d'échancrures." These "saillies" resemble those of *difformis*, but are certainly not quite so strong, and so Perez tells us, giving other minute details as to points unnoticed by Morawitz.

So far all seems satisfactory, but—

(1) Morawitz says that his species instead of visiting *Echium* like *adunca*, etc., visits "exclusively" *Lotus corniculatus*.

Now *morawitzi*, Perez, undoubtedly visits *Echium*, and Perez gives as its plants "Echium and Lotus."

(2) There exists another species; differing from Perez's but possessing likewise the antennal characters of *loti*; which (like Morawitz's *loti*-types) occurs in Switzerland, and which seems to me to correspond even better than *morawitzi*, Perez, to the description of *loti*.

Of this species I have two ♂♂ taken on the Petit Salève near Geneva, while I have only found *morawitzi*, Perez, in South France and Algeria.

This is the insect to which belong my Figs. 11, 20, 21, 27, 27a, 27b.

I think it must be rather rare, as it seems unknown to Ducke, and I have seen no specimens of it except my own. (There are none in Mr. Saunders's collection, apparently.) The ♀ I do not know: and Gerstæcker says that Morawitz took no females of his *loti*, those which he supposed to be such being really only *cæmentaria*.

It differs from *morawitzi*, Perez, which it strongly resembles, in several important points. (1) The ♂ 6th ventral segment (Fig. 11) is totally different, almost exactly like that of *difformis*; (2) the femora have not spinosely produced apices, as in Perez's species (Fig. 19). (Unfortunately Morawitz is silent as to these characters in his description of *loti*.) (3) The antennal joints are rather more transverse. (This suits *loti*.)

Another, but a trifling, difference is in the colour of the antennæ. These are more brightly red in the Swiss species. So far as it goes, that is in favour of identifying

it, rather than the Algerian species, with *loti* Morawitz. But it is merely a question of degree.

On the whole, in spite of the points of agreement between *loti*, Mor., and *morawitzi*, Perez, I think that the former insect is probably not identical with the latter, but rather with my specimens from the Petit Salève. And (*pace* Gerstæcker) I do not see why it should not keep the name of *loti*, Mor. (I am not at all satisfied as to Morawitz's females being really *cæmentaria*, however closely to Gerstæcker's eye they may have resembled them.)

Accordingly in my opinion we have four distinct species, as follows—

1. *loti*, Mor. (♂! ♀?) (= *morawitzi*, Gerst.!).
2. *morawitzi*, Perez (nec Gerst.? nec Ducke!).
3. *difformis*, Perez (nec Ducke! = *morawitzi*, Ducke).
4. *pallicornis*, Friese (= *difformis* Ducke! nec Perez!).

I sincerely hope that this note will not be taken as an impertinent attack on Herr Ducke's most suggestive and valuable work. Although my conclusions differ from his, I should never have been in a position to draw any conclusions at all about these bewildering species without the materials he has collected. And it is certain that his book goes far beyond anything yet published towards facilitating the study of *Osmia* for ordinary entomologists.

Specierum quas pro novis habeo diagnoses.

1. *O. manicata*, n. sp. (Figs. 3, 3a, 23, 23a.)

♂ niger; facie pedibus subtus que pallido-, superne fulvo-pilosus abdominis fimbriis stratis apicalibus concoloribus. Exemplaribus permagnis *aduncæ* simillimus: differt antennis basi fortius dilatatis, articulis intermediis pro latitudine longioribus subquadratis, tarsis anticis multo densius fimbriatis, calcaribus posticis pallidis, punctis sculpturaque fortioribus, præcipue autem segmento ventrali sexto nec ante apicem bipenicillato nec in spinam deflexam producto, sed ante incisuram marginis medii profundam carina alta dentiformi instructo. Long. 16 mm.

♀ nobis ignota.

Habitat. ALGERIA; INSULÆ IONIÆ.

2. *O. romana*, n. sp.? (Figs. 8, 26.)

♂ antennarum articulo ultimo ut in *acuticorni* etc. paene monstrose hamiformi. Ceteroquin vix a *cæmentaria* distinguenda, nisi forte segmento dorsali sexto acutius bidentato; margine huius medio sat

profunde inciso; ventralis sexti lobis incrassatis magis approximatis, (igitur incisura triquetra angustiore divisis, nec inter se tam magnam partem processus apicalis amplectentibus).

♀ nobis ignota.

Habitat. ROMA.

3. *O. flabellifera*, n. sp. (Fig. 9.)

Species aspectu *O. lepelletieri* simillima, corpore paullo nitidiore.

♂ facile dignoscitur segmento dorsali septimo apice lato in medio plus minusve inciso (igitur fere bilobato): ventralis sexti lobis præcipuis apicibus acutis et inferne dentiformibus, hiatu inter hos multo minus profundo, processu apicali magis exserto lobis fere rotundis, breviter subtilissime pilosis, haud oblique sed transverse excurrentibus.

Antennæ maris leniter deplanatæ, fere simplices, articulis omnibus latitudine longioribus. Segmenti mediani area cordiformis opaca basi longitudinaliter striata. Segmentum dorsale sextum margine apicali crenulato, in medio haud exciso. Ventrale quintum apice late leniter emarginato, punctis fere ut in ♂ *lepelletieri*.

♀ a *lepelletieri* vix distinguenda, nisi forte pilis brevioribus minusque densis, dorsum certe abdominis aliquo modo nitidius videtur, etiam fimbriis apicalibus haud conspicuis (an in exemplaribus meis 2 detritis?)

Habitat. JUDEA; SYRIA.

4. *O. libanensis*, n. sp. (Figs. 17, 30.)

Adunca similis sed minor (long. circ. 8-9 mill.) abdomine fortius punctulato, calcaribus pallidis.

♂ antennis deplanatis, articulis flagelli antice 3, 4, 5 fere aequè latis, inde usque ad apicem lenissime sensim angustatis, postice articulis 2 et 3 inferne fortissime, 4 lenius, ceteris haud vel vix gibbose productis.

Segmento ventrali 5to apicem versus et in medio sat dense punctulato, basi utrinque evidenter penicillata (!) margine apicali quasi duplici, in medio inciso, lateraliter spinose subtus densato: 6to, lobis præcipuis singulariter apicibus non ad latera segmenti sed in medio sitis, processus basim celantibus—hoc fere omnino ut in *morawitzi* formato, lobis longis angustis transverse excurrentibus.

♀ ab *adunca* calcaribus pallidis, corpore minore, abdomine fortius punctulato, segmento ventrali sexto apice haud spinose producto; a *cæmentaria difformi* etc. abdomine brevissime tenuiter piloso facillime distinguenda.

Habitat. SYRIA (Brumana in Libano).

EXPLANATION OF FIGURES IN PLATE VII.

♂ 6th ventral segment, viewed ventrally, in

- FIG. 1. *O. adunca*, Pz. (1a. apex of do. laterally).
2. *O. lysholmi*, Friese (2a. apex of do. laterally).
3. *O. manicata*, n. sp. (3a. apex of do. laterally).
4. *O. morawitz*, Perez (nec Ducke).
5. *O. pici*, Friese.
6. *O. cæmentaria*, Gerst.
7. *O. lepelletieri*, Perez.
8. *O. romana*, n. sp.
9. *O. flabellifera*, n. sp.
10. *O. jheringi*, Ducke.
11. *O. loti*, Mor. (?).
12. *O. difformis*, Perez (*morawitzii*, Ducke).
13. *O. pallicornis*, Friese (*difformis*, Ducke).
14. *O. insularis*, Schmiedekn.
15. *O. fertoni*, Perez.
16. *O. xanlogeri*, Perez (probably).
17. *O. libanensis*, n. sp.
18. *O. adunca*, ♂ femur.
19. *O. morawitzii*, Perez.
20. *O. loti*, ♂ 7th and 8th ventral segments.
21. ,, ♂ genitalia.
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EXPLANATION OF FIGURES IN PLATE VIII.

♂ Antenna of

- FIG. 22. *O. lysholmi*.
23. *O. manicata* (in front), 23a (from above).
24. *O. morawitzii*, Perez. 24a, 24b (from behind).
25. *O. pici*.
26. *O. romana* (apex only).
27. *O. loti* (?) (in front), 27a (from above), 27b (behind).
28. *O. difformis* (in front), 28a (from above), 28b (behind).
29. *O. pallicornis* (in front), 29a (from above), 29b (behind).
30. *O. libanensis*.
31. 7th dorsal segment in *O. flabellifera*.